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ABSTRACT

A project was conducted by the National Automotive Technicians Education Foundation to review and update the standards for automobile, collision repair and refinishing, and medium and heavy truck technician training programs. The standards include a task list, tools and equipment requirements, program hour requirements, instructor qualifications, and program standards. The review process included committees and workshops with participants from the following groups: vehicle manufacturers, trade association members, independent and dealership technicians and owners, automotive instructors, educational administrators, government, consumer groups, and equipment suppliers, and other industry partners. Other project activities were as follows: identifying the reading, writing, mathematics, and science skills associated with the technical tasks identified in the program standards updates in order to create a certificate of basic competencies; training evaluation team leaders; promoting the standards throughout the United States; and assisting schools in initiating self-evaluation of their automotive repair and auto body repair technicians. Formative evaluation was conducted throughout the project. A summative evaluation, conducted by the Center on Education and Training for Employment at the Ohio State University, concluded that the updated standards and certification requirements improve the learning that takes place in an automotive repair program. (KC)

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ED 408 465

FINAL REPORT ON GRANT ACTIVITIES

FOR U.S. DEPT. OF EDUCATION

BUSINESS & EDUCATION STANDARDS

PROGRAM

GRANT NUMBER V244A20010

NATIONAL AUTOMOTIVE TECHNICIANS EDUCATION FOUNDATION (NATEF)
13505 DULLES TECHNOLOGY DRIVE, SUITE 2
HERNDON, VA 20171-3421

JUNE 23, 1997

CE 074 263

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TABLE OF CONTENTS

SECTION ONE: ACCOMPLISHMENTS AND OBJECTIVES	1
Objective One - Update Standards	1
Objective Two - Applied Academics	3
Objective Three - Evaluation Team Leader Training	4
Objective Four - Promotion of Standards	4
Objective Five - Assisting Schools in Initiating the Self-Study	6
SECTION TWO: SCHEDULE OF ACCOMPLISHMENTS	6
Summary of Milestones for NATEF Skills Standards Grant	8
SECTION THREE: PROJECT PARTICIPANTS	9
SECTION FOUR: DISSEMINATION ACTIVITIES	10
SECTION FIVE: EVALUATION ACTIVITIES	11
SECTION SIX: CHANGES TO KEY PERSONNEL	12
APPENDIX:	
The Effects of Standards on Learning in Automotive Repair Programs	

FINAL REPORT OF GRANT ACTIVITIES FOR U.S. DEPT. OF EDUCATION BUSINESS AND EDUCATION STANDARDS PROGRAM

National Automotive Technicians Education Foundation (NATEF)

Grant Number V244A20010

SECTION ONE: ACCOMPLISHMENTS AND OBJECTIVES

The National Automotive Technicians Education Foundation (NATEF) had a nine year history of standards development for automotive technician training programs when it applied for funding under the Business and Education Standards Program. NATEF is a 501 (c) (3) organization, separate from, but associated with, the National Institute for Automotive Service Excellence (ASE). NATEF's primary purpose is to evaluate training programs against standards, identified by the automotive industry, for certification by ASE. NATEF began with standards for automobile technician training, added autobody (now called collision repair & refinish) in 1989, and medium/heavy truck in 1992.

Although the standards were endorsed by the automotive industry and education alike, NATEF recognized that they must be regularly reviewed and updated to have value. Therefore, the first objective stated in the grant application was to update the standards for automobile, collision repair & refinish, and medium/heavy truck technician training programs. The second objective designated in the application was to identify the reading, writing, mathematics, and science skills associated with the technical tasks identified in each of the three automotive areas. These applied academic skills would be the source for a certificate of basic competencies. Other stated objectives included: training Evaluation Team Leaders (ETLs), promoting the standards in states, and assisting schools in initiating the self-study (self-evaluation). **All of the objectives were accomplished.** Each of the objectives will be discussed in detail in this report.

Objective One - Update Standards

As previously noted, the first objective dealt with the update of the standards for each automotive (automobile, collision repair & refinish, and medium/heavy truck) area. The standards include: task list, tools and equipment, program hour requirements, instructor qualifications, and program standards. The process used for updating was repeated for each program area.

The process drew upon participation of individuals from the well-developed partnerships forged by ASE, since its inception in 1972, and subsequently followed by NATEF. Namely, vehicle manufacturers, trade association members, independent and dealership technicians and owners, automotive instructors, educational administrators, government, consumer groups, and equipment suppliers are examples of industry partners. Hence,

committees of individuals who represent a broad spectrum of the automotive industry participated in the update workshops.

The collision repair & refinish standards were reviewed on February 2-4, 1993 in Herndon, Virginia. The project director and ASE technical staff co-facilitated the workshop. The task list, which served as the foundation, was reviewed first. In addition to the NATEF task list, participants referenced the most current ASE task list, used for the development of the ASE technician certification tests. Priority ratings were established for each task. The tool and equipment list, including hand tools, general shop tools and equipment, and specialty tools and equipment, was then determined. Hour requirements for each area within collision repair & refinish (structural analysis & damage repair, non-structural analysis & damage repair, mechanical & electrical components, plastics & adhesives, and painting and refinishing) were set. Instructor qualifications and program standards were reviewed and modified.

Upon the conclusion of the workshop, the NATEF staff incorporated all the changes into a document that was mailed to all participants for their review for accuracy. Once it was determined to be accurate, the document was submitted to the NATEF Board of Trustees and the ASE Board of Directors for their review and approval. Approval was granted at the November 1993 board meetings. A phase-in period was established for programs already in the process of program certification.

Once the standards were approved by the NATEF and ASE boards, the Evaluation Team Leader manual, program certification manual, and team member booklets were changed accordingly.

The automobile program standards were reviewed and updated on June 8-10, 1993 in Herndon, Virginia. The eight automobile areas for program certification include: Engine Performance, Electrical/Electronic Systems, Brakes, Suspension & Steering, Automatic Transmission/Transaxles, Manual Drive Train & Axles, Heating & Air Conditioning, and Engine Repair. The process was identical to that previously discussed for collision repair & refinish. The changes were approved at the November 1993 meetings of the NATEF and ASE boards.

Lastly, the medium/heavy truck standards were reviewed and updated on December 7-9, 1993. The following eight areas are included in medium/heavy truck: Gasoline Engines, Diesel Engines, Electrical/Electronic Systems, Drive Train, Suspension & Steering, Brakes, Preventive Maintenance Inspection, and Heating & Air Conditioning. The process identified above was used. The NATEF and ASE boards approved the changes at their respective meetings in March and May of 1994.

It is significant to note that NATEF updated the automobile standards in March of 1996 and the collision repair & refinish standards in September of 1996 <u>without the use of grant funds</u>. The medium/heavy truck standards will be updated in August of

1997. This demonstrates the commitment to the standards by both the NATEF and ASE boards and the value of standards to the automotive industry and to schools.

Objective Two - Applied Academics

The second objective as stated in the application involved the identification of the applied academic skills of reading, writing, mathematics, and science that would be the basis for a certificate of basic competencies. Since this was a new responsibility for NATEF, the project director spent time researching methodologies that could be employed. V-TECS was awarded the contract and the research design was mutually established.

The Basic/Essential Skills Taxonomy, developed by Dr. Les Snyder at Arizona State University, was used for the coding system of the language arts, mathematics, and science skills. The NATEF task list provided the technical skills required for entry into automobile, collision repair & refinish, and medium/heavy truck technician careers. The entire project was a collaborative effort.

V-TECS identified subject matter experts in each of the related academic fields and NATEF identified ASE certified technicians as the technical experts. Workshops were convened at different locations around the country for each automotive area. The same academic experts were used in each of the workshops whereas the technical experts changed with each location.

The workshops began with an explanation of the project and the process that would be used. The academic experts each carefully defined the taxonomy codes in common language and provided examples of how the codes could be applied in daily life. Once the codes were defined, the groups turned the focus to their application to automotive tasks.

The academic experts systematically led the participants through the NATEF task list by examining each of the automobile tasks in terms of the academic skills required to perform the task. For example, each task in the Engine Performance category would first be examined for the related science skills. Once every science skill had been identified, the groups would look at each task in terms of the mathematics skills required. The process was followed a third time to identify the language arts skills.

After the academic skills lists were completed, workshop participants were asked to identify the workplace skills required on the job. The participants were given the V-TECS/ Illinois Workplace Skills List and asked to rate each item for importance to their specific occupation. Any item that was rated as important by a majority of participants was included in the published results.

The applied academic skills workshops for automobile technicians were accomplished in a series of four workshops held in Atlanta, Georgia; Boston, Massachusetts; Cincinnati, Ohio; and Phoenix, Arizona. The collision repair & refinish workshops were conducted in Fort Lauderdale, Florida and Pittsburgh, Pennsylvania. The following four cities hosted

the medium/heavy truck applied academic workshops: Bessemer, Alabama; Melrose Park, Illinois; Beaverton, Oregon; and Clayton, Ohio.

NATEF published the results of the research in three books: *The Applied Academics and Workplace Skills For Automobile Technicians, The Applied Academics and Workplace Skills For Collision Repair & Refinish Technicians, and The Applied Academics and Workplace Skills For Truck Technicians.*

Objective Three - Evaluation Team Leader Training

The role of the Evaluation Team Leader (ETL) is critical to ASE certification of automotive training programs. ETLs are instructors who are ASE certified master technicians in their field, have both teaching and technician job experience, and have been trained by NATEF to lead the on-site evaluation of programs going through the certification process. The ETLs must be knowledgeable about the ASE certification program policies and procedures and be willing to lead a group of technicians through the on-site evaluation. ETLs are responsible for writing the final report submitted to NATEF and may be called upon to verify improvements a school may be required to make to meet the standards.

Since ETLs are familiar with the standards for certification, they may also be asked to mentor programs going through certification for the first time. Programs may simply ask an ETL for advice organizing documentation required for the on-site evaluation. Others may wish more extensive assistance. For the services they provide, ETLs are one significant link between programs and the NATEF office.

To avoid costly travel expenses for programs going through the certification process, NATEF makes every attempt to have currently trained ETLs in every state. Under the grant, states were able to request ETL training in their states at no additional cost to the state. Grant funds paid the travel expenses for the NATEF consultant or staff member to conduct the training session. ETL training was also offered at the following national conferences: American Vocational Association (AVA), Vocational Industrial Clubs of America (VICA), and North American Council of Automotive Teachers (NACAT). Over the grant period, 33 ETL training sessions were requested by 25 different states and 13 were held at national conferences, for a total number of 46 ETL training sessions. Three additional states that hosted a national conference elected to use the conference for their ETL training needs rather than hosting a separate training session. In all, ETL training took place in 28 states.

Objective Four - Promotion of ASE Standards

NATEF used numerous methods to promote the use of the standards for ASE certification of automotive training programs. At least 102 presentations were made by the project director and the NATEF consultants at conferences and meetings, 33 of them at national conferences. The presentation topic varied from general information about NATEF and

ASE to specific information about ASE program certification, skill standards, or applied academics, for example. Not included in the tally are the countless times that NATEF information was part of a presentation made by the ASE staff.

In order to assist schools and promote certification, NATEF staff and consultants developed a workshop, "An Instructor's Guide to ASE Program Certification", to be presented at state and national conferences. General information was given on NATEF and ASE as well as topics such as standards development, barriers and ways to overcome the obstacles to certification, the collection and organization of documentation materials, and the establishment of a timeline for the self-evaluation. NATEF received positive feedback from workshop participants after the sessions.

NATEF exhibited at 19 state and national conferences during the grant period. Not included in the number were the displays with information about NATEF done by others (instructors, board members, ASE consultants or staff, etc.) where grant funding was not used for travel or other costs associated with the display.

In addition to presentations and exhibits, NATEF used print media to promote the standards. The NATEF NEWS was a quarterly newsletter distributed to schools, state Trade & Industrial supervisors, board members, the automotive trade press, and others from winter 1994 - summer 1995. The newsletter was suspended when staff were no longer available to produce it on a regular schedule. At about that same time, however, the ASE Communications staff began a quarterly four-color newsletter called the TECH NEWS. Each issue contains articles that relate directly to NATEF. TECH NEWS has a circulation of over 500,000. Copies are mailed to all ASE certified technicians (many of whom are instructors or advisory committee members in schools), board members, the automotive trade press, and others. All ASE certified programs receive at least one copy of the TECH NEWS. NATEF was featured on the front page several times, once when President Clinton visited the ASE certified programs at Shoreline Community College in Seattle, Washington.

Several brochures were produced with grant funds. A brochure on NATEF evaluation and ASE program certification was updated. Three new brochures were developed featuring careers as automobile technician, collision repair & refinish technician, and truck technician. These brochures were widely distributed throughout the country.

The Career Tracks video was updated to include collision repair & refinish and truck areas. A new series of videos was produced, in part with grant funds. The Career Encounters: Automotive Technician® video is documentary in style and features careers in automobile, collision repair & refinish, and medium/heavy truck areas. This video, produced by Davis-Gray, Inc., is 28.5 minutes long and was on PBS, the Mind Extension University, and other classroom satellite broadcasts at least six times over a two year period. The grant paid for the development of the video while ASE paid for the production of three short versions of the video featuring one career area. In addition, ASE

paid for the development of a Presenter's Guide, packaging, and copying all four versions of the video. The package comes complete with a set of the career brochures and information on NATEF and ASE.

NATEF staff have responded via phone, fax, or mail to innumerable inquiries about NATEF. The project director and consultants attended the project directors meetings. Additionally, the project director spent many hours responding to direct inquiries about NATEF and the skills standards grant. The project director met individually with representatives from other skill standards grants including: heating and air conditioning, metalworking, and the electrical construction workers. The purpose of the meetings was to familiarize the other grantees with the ASE certification process for technicians and the ASE training program certification through NATEF evaluation of schools.

Additional promotion was accomplished through articles in various publications including, but not limited to, Vocational Education Journal, Automotive Body Repair News, The Manifold, Journal of Vocational Education Research, and AutoInc.

Objective Five - Assisting Schools in Initiating the Self-Study (Self-Evaluation)

The "Instructor's Guide to ASE Program Certification" workshop, previously discussed, was developed to assist programs that are new to the certification process. Instructors, administrators, and counselors are encouraged to attend as a team. In addition to the project director and NATEF consultants, others familiar with the certification process, such as ETLs, have given the workshop in their states. This workshop has been assimilated into regular dissemination activities .

Many ETLs and other instructors from ASE certified programs have volunteered time to assist schools through the certification process on a one-on-one basis or as a group activity. These dedicated individuals believe in the benefits of standards and are willing to help others achieve those standards. NATEF recommends that instructors from programs undertaking certification for the first time talk to instructors from ASE certified programs about the process and ask for suggestions for preparing for certification.

NATEF staff and consultants have also done site visits of programs, upon request, in conjunction with travel within the program's geographic area. These visits were informal in nature and recommendations were made for preparation of the self-evaluation.

SECTION TWO: SCHEDULE OF ACCOMPLISHMENTS

When the original application was submitted, the project director had not been hired. Consequently, when the project director was hired she reorganized the sequence for some of the grant activities. The changes effected the timeline only, not the objectives or scope of work. A formal modification of the timeline was submitted to the DoED grant program manager and budget manager on October 19, 1993.

The following chart is a summary of the dates of completion of the objectives as indicated in the application, in the amended timeline, and the actual date of completion. In the application, estimated completion dates were given according to calendar months. The revised timeline looked at completion dates in terms of first or second funding period. At the end of the three year grant period not all funds had been expended, therefore, NATEF requested and was granted an 18 month extension of time to spend allocated funds for continuation of promotional activities, dissemination of information, and training ETLs. No additional grant funds were requested.

SUMMARY OF MILESTONES FOR NATEF SKILLS STANDARDS GRANT

OBJECTIVE	COMPLETION DATE ON APPLICATION	COMPLETION DATE ON REVISED TIMELINE	DATE COMPLETED
Revise automobile standards	7/1/93	3/31/94	11/93
Identify applied academic skills - automobile	10/1/93	3/31/94	review completed 2/94; final edit & books printed 2/95
Revise collision repair & refinish standards	10/1/93	3/31/94	11/93
Identify applied academic skills - collision repair & refinish	4/1/94	9/30/95	review completed 7/94; final edit & books printed 6/95
Revise medium/heavy truck standards	10/1/94	review by 3/31/94; approve by 9/30/95	review completed 12/93; approved 5/94
Identify applied academic skills - medium/heavy truck	10/1/94	9/30/95	review completed 2/95; final edit & books printed 10/95
Train ETLs	10/1/94	ongoing throughout grant	3/31/97
Promote standards in states	10/1/94	ongoing throughout grant	3/31/97
Assist schools to initiate self-evaluation	9/30/95	9/30/95	3/31/97
Revise Career Tracks video	10/1/94	3/31/94	revised 6/93; *produced new video* Career Encounters - Automotive Technician® 2/96
Basic skills identification for Certificate of Basic Mastery	9/30/95	9/30/95	10/95

As previously stated, all of the objectives stated in the application were accomplished. The one objective that took significant additional time was the identification of the applied academics skills. The reason this took additional time was the significant depth of research that was completed. At the onset of grant activities, a research plan for the applied academics research had not been developed. Once NATEF contracted with V-TECS, the process became a collaborative effort. Gathering the data was relatively simple compared to presenting the results in a meaningful manner for a variety of audiences. It is the most extensive research to date on related academic and technical skills. Editing the books took a great deal of time, more than either V-TECS or NATEF anticipated. Ultimately, NATEF completed the final editing of all three books.

Another difference between the application and the revised timeline related to two objectives. The application gave the completion date for training ETLs and promotion of the standards in states as 10/1/94. The project director believed from the onset that the date was an error in typing the application and was always intended to be an ongoing activity.

During the extension period, NATEF learned of the Career Encounters video series produced by Davis-Gray, Inc. The award winning series typically examined careers requiring a baccalaureate degree. However, due to significant interest in skill standards, tech prep, and school-to-work issues, Davis-Gray, Inc. was interested in expanding the series to include technical careers not requiring a baccalaureate degree. The project director received permission to have the Career Encounters - Automotive Technician® video produced to disseminate information and promote the career area. The video has been a success and it won an award for Excellence and Innovation from the American Association of Career Educators (AACE) in April of 1997.

SECTION THREE: PROJECT PARTICIPANTS

As previously stated the three committees, charged with the responsibility to review and recommend revisions to the automobile, collision repair & refinish, and medium/heavy truck standards, represented a broad spectrum of the automotive industry. All of the committees' recommendations for change were reviewed and approved by the NATEF Board of Trustees and the ASE Board of Directors.

Identification of the applied academic skills required a combined undertaking by V-TECS and NATEF. V-TECS was selected because of their history in occupational analysis and their more recent success working with the Basic/Essential Skills Taxonomy. Dr. Ron McCage selected the academic experts used in each area: Ms. Barbara Blasch, mathematics; Dr. Chrysandra Spiceland, language arts; and Dr. Trina Boteler, science. Dr. Patricia Lundquist, NATEF project director, selected the technical experts, all of whom were ASE certified technicians. Every person involved in the project contributed significantly to the final product, namely, *The Applied Academics and Workplace Skills For Automobile Technicians, The Applied Academics and Workplace Skills For Collision*

Repair & Refinish Technicians, and The Applied Academics and Workplace Skills For Truck Technicians.

NATEF also entered into a contractual relationship with the National Association of State Directors of Vocational-Technical Education Consortium (NASDVTEC). The purpose of the contract was to examine the NATEF standards to ensure that there was no bias as to race, gender, or physical attributes. Ms. Barbara Border of Educational Leadership Consultants did the work on the project. The report from NASDVTEC indicated that there was no evidence of bias in the NATEF standards.

Other examples of the high caliber of individuals who worked with NATEF on the project are Mr. Mike Davis and Mr. Gary Gray. The Career Encounters: Automotive Technician® video produced by Davis-Gray, Inc. was professionally done under the guidelines of the contract with NATEF. The NATEF project director identified the locations for filming the video and Mike Davis, producer, selected the individuals to interview. As mentioned in section two, the video recently won an award from AACE.

It would be remiss if this report did not include the NATEF and ASE staff, consultants, and board members for their dedication to the project and to the stated missions of both organizations. Since this project took existing standards and updated them in addition to creating new materials, the contributions made by the staff and consultants from the onset were part of their daily activities. The counsel of the board members and the consultants proved invaluable throughout the project.

SECTION FOUR: DISSEMINATION ACTIVITIES

Dissemination activities must be examined in terms of the promotional activities discussed in more detail in Objective Four of Section One. Presentations were made at national and state conferences and meetings, exhibits at conferences, videos and brochures were produced , and articles were published with the intent of disseminating information about the national standards for the automotive industry through NATEF evaluation and ASE certification of training programs and technicians. (Refer to Section One - Objective Four for information on the number of activities and detailed descriptions of the activities.)

Specific information about changes to the standards, ETL training, promotional activities, and applied academics was distributed by memo or letter to the following, as deemed appropriate for each news item: state T & I supervisors, State Directors of Vocational-Technical Education, ASE certified programs, ETLs, and schools in process of certification.

Dissemination was, and continues to be, an ongoing activity, as information is provided daily in response to inquiries via telephone, fax, and mail. The program standards books, certification manuals, and ETL manuals have been "packaged" differently as a result of

the grant, which made them easier to understand and to distribute. The standards are available in a GBC bound book, free of charge to all interested parties. The three applied academics books are also GBC bound and are free of charge. All ASE certified programs received a copy of the applied academics book, appropriate to their program area, when the books were printed. The career brochures were also distributed to all ASE certified programs and they continue to be available to all interested parties at no cost. The Career Encounters: Automotive Technician® video is sold on a cost recovery basis for $22.95.

SECTION FIVE: EVALUATION ACTIVITIES

Formative evaluation, while relatively informal, was instrumental for the success of the project. Although no workshop committee was ever identical, the process for the selection of participants and the procedures used during the reviews remained constant. Workshop participants were selected by ASE and NATEF staff or board members because they represented a segment of the automotive industry. Workshops were facilitated by ASE technical staff and the NATEF project director and any change required group consensus. These processes and procedures have served ASE and NATEF well over the years. However, the timeline was modified slightly as discussed in Section Two.

The formative evaluation of the applied academics led the project director and V-TECS to modify the plan for editing the published results. The project director completed the final edit immediately prior to printing the books.

Progress on the grant was discussed at the regular meetings of the NATEF Board of Trustees and the ASE Board of Directors. The appropriate follow-up to suggestions was completed by the NATEF project director or consultants.

The *summative evaluation* was conducted by the Center for Employment and Training at The Ohio State University, as indicated in the grant application. Dr. Morgan Lewis, Principle Investigator, studied the effect of program standards on student learning. The ASE certified and noncertified programs in the study were matched for similarity. All noncertified programs had requested a copy of the ASE certification manual, but had not completed the self-evaluation. The outcome measure of learning used test items from a standardized test. Differences in intelligence of students were statistically controlled. In addition to testing students, on-site evaluations of all programs in the study were conducted in the same manner as for ASE program certification. The Ohio State University researchers concluded that "certification improves the learning that takes place in an automotive repair program" (p. 10). [1] A full copy of the results dated September 1995 can be found in the Appendix of this report.

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[1] Lewis, Morgan V., & Gill, Lawrence (1995). The Effects of Standards on Learning in Automotive Repair Programs. Columbus: The Ohio State University, Center on Education and Training for Employment.

SECTION SIX: CHANGES TO KEY PERSONNEL

At the time the application was submitted, a project director had not been hired. Dr. Patricia Lundquist was subsequently hired on October 8, 1992 to fill the position. She submitted a vitae to Ms. Debra Nolan, DoED project manager at the time, and received verbal approval to act in the capacity of project director for NATEF.

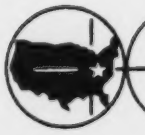
The application also indicated the need for a third NATEF consultant. Mr. Sam Rosen served in that capacity for several months. However, at the end of his first contract period, Mr. Rosen's contract was not renewed.

Dr. Byrl Shoemaker formally retired from providing regular services to NATEF in June of 1996 and Dr. Darrell Parks replaced Dr. Shoemaker as NATEF consultant.

All other ASE and NATEF personnel named in the application remained in their positions for the duration of the grant.

APPENDIX

THE EFFECTS OF STANDARDS ON LEARNING IN AUTOMOTIVE REPAIR PROGRAMS



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THE EFFECTS OF STANDARDS ON LEARNING IN AUTOMOTIVE REPAIR PROGRAMS

A Third-Party Summative Evaluation of
the Standards Established by the
National Institute for Automotive Service Excellence

Morgan V. Lewis
Lawrence Gill

Conducted for
National Automotive Technicians Education Foundation, Inc.
13505 Dulles Technology Drive
Herndon, Virginia 22071-3421

August 1995

Center on Education and Training for Employment
The Ohio State University
1900 Kenny Road
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FOREWORD

The Center on Education and Training for Employment of The Ohio State University is pleased to submit this third-party, summative evaluation to the National Automotive Technicians Education Foundation (NATEF). This evaluation compared programs that were certified as meeting the standards established by the National Institute of Automotive Service Excellence (ASE) to very similar noncertified programs.

The noncertified programs selected for the comparison group had made the initial steps toward obtaining ASE certification, but at the time of the data collection were not certified. An indication of how close some of the comparison programs were to certification is that one of them became certified only two months after providing data as a noncertified program.

Despite the similarity of the certified and noncertified programs, the test results indicate that ASE standards do have a positive influence on the learning that takes place in automotive repair training programs.

The study was designed by Dr. Morgan Lewis, Research Scientist from our Center, in cooperation with Dr. Patricia Lundquist, the manager of the NATEF skills standards project, and Dr. Byrl Shoemaker, consultant to NATEF. Dr. Lewis selected the programs for the study and prepared this report with the assistance of Mr. Weidong Wang, who conducted the computer analyses. The data collection for the project, including the development of the test of automotive repair, was directed by Mr. Lawrence Gill, formerly a Vocational Education Consultant/Testing Specialist with the Vocational Instructional Materials Laboratory of our Center.

On behalf of all those associated with this study, I would like to express our appreciation to the administrators, teachers, and students of the eight programs, secondary and postsecondary, certified and noncertified, in Florida and Pennsylvania who provided the data that made the evaluation possible. Needless to say, without their cooperation this study could not have been conducted.

Ray D. Ryan
Executive Director
Center on Education and
Training for Employment
College of Education
The Ohio State University

Introduction

In May 1994, a National Skills Standards Board was established by Title IV of the Goals 2000: Educate America Act. With the passage of this legislation, the nation acknowledged that if American companies are to be effective competitors in global markets, they need workers whose skills are as good as any in the world.

The partners in the automotive industry who created the National Institute for Automotive Service Excellence (ASE), and later the National Automotive Technicians Education Foundation (NATEF)[1], had recognized the need for highly skilled workers more than two decades earlier. The cooperative and voluntary nature of the standards established by ASE served as a model that was adopted for projects to develop standards for other occupations and was incorporated in the title establishing the National Board.

Two years prior to the passage of the legislation, the U.S. Departments of Education and Labor had solicited proposals to select bidders to establish standards for various occupational areas. NATEF was selected by the Department of Education to update and expand the ASE standards. One of the conditions of this funding was that a third-party summative evaluation be conducted to determine the effectiveness of the standards that were developed. This is the report of the third-party evaluation of the standards updated by the NATEF project.

The Center on Education and Training for Employment (CETE), a unit of the College of Education at The Ohio State University, conducted the third-party evaluation. This report describes the methods followed to conduct the evaluation and presents its main finding. The results indicate that students trained in programs certified by ASE have a better knowledge of automotive repair than students in similar noncertified programs. The procedures followed to produce these results are discussed in the following section.

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[1]ASE certifies both programs that train technicians and the technicians, themselves. NATEF is the educational arm of ASE and is responsible for conducting the reviews that determine if programs meet the standards set by ASE.

Method

Hypotheses

These are the hypotheses that the evaluation tested:

1. Students from ASE certified programs score higher than students from noncertified programs on a standardized test of knowledge of automotive repair. This was the primary hypothesis of the evaluation.

2. Students from postsecondary programs score higher than students from secondary programs. This provided a *known-group* validation of the dependent variable.

3. The third hypothesis was a null hypothesis: there is no significant difference in the scores from Florida and Pennsylvania.

4. None of the interactions among the independent variables are statistically significant.

Study Design

A 2 by 2 by 2 analysis of covariance design was used to test these hypotheses. The three dimensions of the design were defined by the following independent variables:

1. Certification: program had been certified as meeting ASE standards or not

2. Level, secondary or postsecondary

3. State where program was located, Florida or Pennsylvania

The dependent variable was the score on a test that measured knowledge of the eight areas of automotive repair on which ASE certifies programs. There was a subtest for each of these areas. The subtests were developed by selecting items from the test bank of the *Ohio Vocational Competency Assessment, Auto Mechanics*.[2] The subtests for Engine Repair and Engine Performance had 15 items each; the subtests for the other six areas had 10 items each. The highest possible score was thus 90 items correct.

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[2]This is a new, criterion-referenced test developed by the Vocational Instructional Materials Laboratory of CETE. The job analysis on which the test is based was conducted in 1992 and the items were written and tested in 1993 and 1994.

The *Test of Cognitive Skills,* Second Edition (CRM-McGraw Hill 1984) was used to adjust the dependent variable scores. This is an intelligence test that is primarily nonverbal. Using scores on this test (hereafter called TCS/2) to adjust scores on the dependent variable controlled for differences in the intelligence of students that were likely to influence their scores on the test of knowledge of automotive repair. By controlling for individual difference in intelligence, the analysis yielded a more precise estimate of the effect of certification.

Site Visits

In addition to testing students at the end of their programs, NATEF-recruited teams conducted site visits at each of the programs that cooperated in the evaluation. These teams were led by experienced automotive instructors who had been trained by NATEF. Two automotive repair technicians from the localities served by the programs served as the other members of each team. The site visits were conducted in the same way as a regular certification visit. The cooperating schools and colleges were not asked to complete a full self-evaluation prior to the visit, but they did assemble background information about their programs for review by the teams.

Sample

As in any summative evaluation, the most difficult part of the study was defining and selecting the comparison group that would be used to test if ASE certification had a significant effect on the learning that takes place in an automotive repair program. The group that was selected provided a rigorous test of the effects of certification.

The comparison group was selected from automotive repair programs that had made an initial inquiry to ASE concerning certification, but had not at the time of sample selection completed and returned the self-evaluation forms that are the first step in the certification process. The study was limited to automotive repair, because there were inadequate numbers of auto body and truck programs from which to select the certified and not yet certified programs.

Four automotive repair programs, two secondary and two postsecondary, were selected in both Florida and Pennsylvania. One of the programs at each level was an ASE-certified program and the other was not certified, but had made an initial inquiry about certification.

Attempts were made to select certified and noncertified programs in each state that were as similar as possible. Certified programs in high schools, regional vocational centers, and community colleges were matched with similar noncertified programs, controlling, where possible, for the populations and types of geographic areas the programs served.

Results

Validity of the Dependent Variable

As the first step in the analysis, the subtest scores for the eight areas of automotive repair on which ASE certifies programs were correlated with the total scores. These correlations are shown in Table 1. Each of the subtests correlates highly with the total score; the range is from r = .70 to .85. The subtests also correlate with each other significantly, but at a lower level; the range is r = .42 to .66.

TABLE 1

INTERCORRELATIONS OF SUBTESTS FOR EIGHT AREAS OF AUTOMOTIVE REPAIR WITH TOTAL SCORE

	TS	ER	EP	AT	MT	SS	BR	ES	AC
Total Score (TS)	1.00	.79	.85	.70	.79	.73	.73	.77	.78
Engine Repair (ER)		1.00	.66	.42	.61	.52	.45	.56	.55
Engine Performance (EP)			1.00	.49	.66	.56	.53	.58	.61
Automatic Transmission, Transaxle (AT)				1.00	.60	.45	.47	.47	.52
Manual Drive Train and Axles (MT)					1.00	.44	.52	.51	.49
Suspension and Steering (SS)						1.00	.49	.53	.54
Brakes (BR)							1.00	.58	.58
Electrical Systems (ES)								1.00	.60
Heating and Air Conditioning (AC)									1.00

These correlations provide evidence for the construct validity of the test. The intercorrelations with the total score indicate that students tend to perform similarly on each of the subtests. High total scores are associated with low scores on the

subtests. The lower intercorrelations among the subtests indicate they are measuring somewhat different types of knowledge.

The TCS/2 had a modest correlation with the scores on the automotive test, r = .38, and slightly lower correlations with the subtests. The correlations with the subtests ranged from .27 to .36. Intelligence, as measured by the TCS/2, had fairly consistent relationships with performance on each of the subtests, but the subtests were obviously measuring much more than just intelligence. Scores on the TCS/2 accounted for 7 to 14 percent of the variability in the scores on the subtests and total test of automotive repair.

Test Scores by Certification, Educational Level, and State

The analysis of test scores by educational level, shown in Table 2, provides a different type of evidence for the validity of the test. This is a *known group* validation, a comparison of groups that have had different levels of experience with the content area that the test measures. Those with greater experience should score higher. Postsecondary students, as expected, scored significantly higher than secondary students on the test.

Table 2 also provides the comparisons by certification that are the focus of this evaluation. In three of the four comparisons, the certified programs had higher average scores than the noncertified programs, and there is a ready explanation for the one exception, the postsecondary program in Florida.

TABLE 2

MEAN SCORES ON TEST OF AUTOMOTIVE REPAIR BY CERTIFICATION, LEVEL, AND STATE

	Florida			Pennsylvania			Total		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
Secondary									
Noncertified	43.83	8.35	6	49.56	11.11	9	47.27	10.19	15
Certified	52.42	12.92	12	60.62	13.00	21	57.64	13.38	33
Total	49.56	12.07	18	57.30	13.31	30	54.40	12.71	48
Postsecondary									
Noncertified	61.27	8.70	11	67.30	10.39	30	65.68	10.19	41
Certified	54.25	15.67	12	71.49	6.12	35	67.09	12.01	47
Total	57.61	13.04	23	69.55	8.54	65	66.43	9.72	88

The noncertified postsecondary program in Florida received its certification just two months after its participation in the study. When this program agreed to participate, it had nearly completed its self-evaluation. It used the feedback from this study's site visit to correct the deficiencies noted, submitted its self-evaluation forms, had a NATEF site visit, and was certified.

Even though the noncertified postsecondary program in Florida had higher average scores than the certified program, the analysis of covariance presented in Table 3 still found certification to be statistically significant.

Table 3 indicates that each of the variables used in the analysis was statistically significant. The significantly higher test scores in Pennsylvania were contrary to Hypothesis 3 of the study and contributed to significant interactions that were contrary to Hypothesis 4.

The higher average score for the noncertified postsecondary program in Florida yielded statistically significant interactions among the variables. One of the assumptions of the analysis of covariance is that there are no significant interactions (Berenson, et al. 1983). As noted above, however, the high average for the noncertified program could be easily explained. Consequently, the interactions were eliminated and the analysis run.

The four variables used in the analysis had a multiple correlation of R = .62 with the automotive test scores. The square of R, .38, indicates the proportion of the variability in the automotive scores that could be explained by these four variables.

Because it was necessary to disregard the assumption of no interactions among the independent variables to run the analysis of covariance, another statistical test was run which allowed interactions. This test, *generalized least squares* (Berenson, et al. 1983) is appropriate because it provides an estimate of each effect, main or interaction, while adjusting each effect for all other relationships among the variables. This test thus removes from the certification effect all variability associated with the other variables and their interactions.

Table 4 presents the results of the generalized least squares analysis including all interactions among the independent variables that were significant at the .05 probability level. These interactions account for much of the explained variance. The important point for this evaluation is that even with all explained variation removed, the certification variable remains significant at less than the .05 probability level.

TABLE 3

ANALYSIS OF COVARIANCE OF AUTOMOTIVE REPAIR SCORES BY CERTIFICATION, LEVEL, AND STATE TEST OF COGNITIVE SKILLS AS COVARIATE

Source	DF	Sum of Squares	Mean Square	F-Value	p. > F
Model	4	8163.29	2040.82	8.95	0.0001
Error	126	13570.45	107.70		
Corrected Total	130	21733.74			
Source					
Certification	1	610.06	610.06	5.66	0.00094[1]
Level	1	2517.41	2517.41	23.37	0.0001
State	1	1953.12	1953.12	18.13	0.0001
TCS/2	1	1700.11	1700.11	15.79	0.0001

Note: Scores on the TCS/2 were missing for five students. Consequently, the automotive repair test scores for these students could not be used in this analysis.

[1]One-tail test with the prediction that scores of students from certified programs will be higher than scores of students from noncertified programs.

Site Visit Results

Results from the site visits had a pattern similar, but not identical, to the test results. The programs were evaluated using the same standards as are used to determine if a program qualifies for certification. ASE has established 10 standards for use in evaluating programs each of which are rated on a five-point scale from poor (1) to excellent (5).

TABLE 4

GENERALIZED LEAST SQUARES ANALYSIS OF AUTOMOTIVE REPAIR SCORES BY CERTIFICATION, LEVEL, STATE, AND TEST OF COGNITIVE SKILLS

Source	DF	Sum of Squares	Mean Square	F-Value	p. > F
Model	8	10245.93	1280.74	13.60	0.0001
Error	122	11487.80	94.16		
Corrected Total	130	21733.74			
Source[a]					
Certification	1	391.23	391.23	4.15	0.0219[b]
Level	1	1055.10	1055.10	11.21	0.0011
State	1	677.15	677.15	7.19	0.0083
Test of Cognitive Skills	1	2547.00	2547.00	27.05	0.0001
Certification*Level	1	577.45	577.45	6.13	0.0146
Certification*State	1	588.36	588.36	6.25	0.0138
Level*State	1	736.64	736.64	7.82	0.0060
Test of Cognitive Skill*Level	1	781.76	781.76	8.30	0.0047

Note: Scores on the TCS/2 were missing for five students. Consequently, the automotive repair test scores for these students could not be used in this analysis.

[a]All variables and interactions that are significant at the .05 probability level or less are shown. Interactions with probabilities above .05 are not listed.

[b]One-tail test with the prediction that scores of students from certified programs will be higher than scores of students from noncertified programs.

The standards regarding the organization, administration, and pedagogy of the program were rated by the team leader, who had been trained by NATEF. The standards regarding the technical aspects of the eight areas of automotive repair shown in Table 1 were rated by all three team members. Table 5 shows the mean ratings for the 10 standards for the eight programs, and the mean test scores of students from these programs.

Because of the way the noncertified programs were selected, they tended to be very similar to the certified programs. The ratings reflect the similarity in the programs. Nevertheless, within the two states, the certified programs received higher average ratings than noncertified programs. The noncertified, postsecondary program in Pennsylvania, however, received higher ratings than the certified secondary programs, and the two certified secondary programs received higher ratings than the noncertified, postsecondary program in Florida.

The rank order correlation between the means of the site visit ratings and the test scores is .77, which is significant at less than the .025 probability level. The major discrepancy is once again the noncertified, postsecondary program in Florida which ranked sixth in the ratings but third in the test scores. As was noted above, this program corrected the deficiencies identified by the site visit and became certified just two months after participating in this evaluation.

TABLE 5

MEAN SITE VISIT RATINGS AND TEST SCORES
OF PROGRAMS PARTICIPATING IN THE EVALUATION

	Program Means	
	Site Visit Ratings	Test Scores
Postsecondary--certified, Pennsylvania	4.77	71.49
Postsecondary--noncertified, Pennsylvania	4.74	67.30
Postsecondary--certified, Florida	4.70	54.25
Secondary certified, Florida	4.69	52.42
Secondary--certified, Pennsylvania	4.64	60.62
Postsecondary--noncertified, Florida	4.54	61.27
Secondary--noncertified, Florida[a]	4.32	43.83
Secondary--noncertified, Pennsylvania	3.91	49.56

[a]Only four of the eight areas certified by ASE were rated for this program. If all eight had been rated, it is likely this program would have had the lowest average ratings.

Discussion and Conclusion

This evaluation provided a rigorous test of the effect of program standards on learning. The noncertified programs were selected to be very similar to the certified programs. The outcome measure of learning used items from a newly developed standardized test. And differences in the intelligence of the students that were associated with performance on the outcome measure were statistically controlled.

The comparison, noncertified programs were so similar to the certified ones that one of them--the Florida, noncertified postsecondary program--changed categories shortly after participating in the evaluation. This program caused the only difference between certified and noncertified program that was not in the expected direction. Even with this discrepancy, however, the statistical tests of the effect of certification were still significant at the .05 probability level.

The results of this analysis make a strong case that certification improves the learning that takes place in an automotive repair program. To provide a rigorous test of the effects of the standards, the noncertified programs were selected to be as similar to the certified programs as possible. It is very likely that if the comparison group had been selected from a more representative population of all noncertified programs, the differences between the certified and noncertified programs would have been larger than those found in this study.

Since this was a summative, not formative, evaluation, it did not attempt to identify the ways in which certification enhances learning, but the results of the site visits give some clues. The most obvious way that standards can influence learning is by ensuring that facilities, equipment, tools, and instruction are relevant to the real needs of the work place. Automotive technicians serve as members of NATEF certification teams to add their knowledge of local practices to the review of programs. Noncertified programs may not have the same level of linkage with the labor market.

The ASE standards also set forth clear objectives for the knowledge and skills students should acquire. These objectives focus instruction and may motivate students by communicating clearly the expectations for satisfactory performance. There is a large body of research that has established that expectations can influence learning either positively or negatively (Rosenthal and Jacobson 1968, Swann and Snyder 1980). It seems unlikely that noncertified programs would have the same degree of clarity in their objectives.

The goal of achieving ASE technician certification may also provide motivation. Students in certified programs know that the instruction they are receiving meets national standards. They can reasonably assume that if they satisfactorily master the skills they are studying, they will qualify for ASE certification after they have acquired the necessary on-the-job experience.

Conclusion

The overall conclusion of this third-party evaluation is that ASE standards have a positive effect on the learning that takes place in automotive repair programs. Students from programs certified by ASE scored significantly higher on a standardized test of knowledge of automotive repair than students from similar noncertified programs. It is highly likely that if the comparison programs were selected to be more representative of all noncertified programs, the differences between certified and noncertified programs would be larger than those found in this study.

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